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A University Engagement Model for Achieving Technology Adoption and Performance: Improvement Impacts in Health Care, Manufacturing, and Government

David R. McKinnis, Mary Anne Sloan, L. David Snow, Suresh V. Garimella

Abstract

The Purdue Technical Assistance Program (TAP) offers a model of university engagement and service that is achieving technology adoption and performance improvement impacts in health care, manufacturing, government, and other sectors. The TAP model focuses on understanding and meeting the changing and challenging needs of those served, always seeking to engage a mix of faculty, staff, students, and others that best meet these needs. Although the TAP mission is focused on the needs of those served, participating faculty and students have experienced significant benefits, and faculty rarely decline an opportunity to participate. This essay presents the evolution of Purdue University's engagement and service missions, and their alignment with the current thinking of engagement scholars and practitioners. The operational model for TAP is described as an important part of Purdue's engagement mission, along with the elements necessary for its success, examples of successful engagement, and future challenges and opportunities.

Introduction

Purdue University, founded in 1869, is a land-grant institution with a long-standing heritage of engagement, outreach, and service. Service to its constituents through mutually beneficial programs and activities has been integral to Purdue's mission throughout its history. Purdue Extension was established in 1914, the Colleges of Consumer and Family Sciences and Veterinary Medicine have had strong service initiatives in place for decades, Statewide Technology (offering degree and certificate programs in 10 locations) began offerings in 1984, the School of Nursing opened its first community clinic in 1981, and several additional initiatives have been established in recent years, including the Technical Assistance Program.

In the year 2000, a member of the Kellogg Commission on the Future of State and Land-Grant Universities assumed Purdue's presidency, and the university fully embraced the imperatives of its new president and the Commission to become an engaged institution (Jischke, 1998; Kellogg, 1999). In 2001, Purdue's Board of Trustees adopted a strategic plan emphasizing learning, discovery, and engagement, and identified "a vital role for Purdue University in strengthening Indiana's economy and improving the qualifications of the state's workforce" (Akridge et al., 2010, p. 141). Engagement and service have been core missions for Purdue's Colleges of Agriculture, Consumer and Family Sciences, and Veterinary Medicine for decades, and since 2001 they have increasingly become part of the fabric of the entire campus. An Office of Engagement was created to support campus and statewide service, an engagement council was formed, and the Technical Assistance Program and other key initiatives in the office were placed under the leadership of associate vice provosts for engagement (now assistant vice presidents for engagement).

In recent years, university engagement scholars and practitioners have presented well-founded arguments appealing for more effective and impact-focused methodologies and initiatives to meet societal needs. These leaders have called for universities to be more accessible to business and industrial sectors that seek partners, consultants, research services, or other assistance (*Role of Engaged Universities*, 2008). Aligning efforts with the priorities of local communities (Creighton, Sweeney, & Wright, et al., 2010), and implementing recognized programs to establish partnerships with practitioners that quickly translate research results into practice (Witz, 2007), were emphasized. Fitzgerald and Simon (2012) recently advanced the concept of a *world-grant university* that encourages engagement with society as a partner in solving complex challenges. University strategies that support innovation and entrepreneurship were recommended by Audretsch and Phillips (2007), and Fitzgerald, Bruns, Sonka, Furco, & Swanson (2012) have proposed that a new framework for engagement must move away from emphasizing scholarly outcomes and move toward emphasizing impact. Beckman, Penney, and Cockburn (2011) asserted that successful impacts require clear goals, evaluations, and broad participation. The major ongoing transformation in higher education renders universities indispensable for economic and community engagement, according to Trani and Holsworth (2010), who noted that requests for university engagement are rapidly multiplying, involving universities in an ever increasing range of community and economic development relationships.

This consensus in the literature closely matches the experiences and outlook of the Technical Assistance Program and its initiatives to achieve technology adoption and performance improvement impacts across a diverse spectrum of stakeholders.

Evolution of TAP's Engagement and Service

The recession of the early 1980s had a major negative impact on jobs in Indiana's largest economic sector at the time, manufacturing. Statewide strategic plans recommended many new initiatives, including state funding for Purdue University to provide business assistance. The Technical Assistance Program was established in January 1986 with a focus on supporting technology adoption and performance improvement in the manufacturing sector. The College of Engineering established and managed the program. Under the directorship of a senior engineering faculty member, a team of faculty and graduate students was engaged to perform short-term, no-cost assistance projects to address a broad range of technology and performance issues and opportunities. Impacts and outcomes of these short engagements were measured and found to be very positive. In the late 1980s, TAP added a fee-based information service that provided access to thousands of technical documents each year. The combination of direct assistance and information services was well received through the late 1990s when the internet began to replace the need for fee-based information services.

By the time Purdue implemented a strategic plan that substantially expanded engagement and service efforts throughout the university in 2001, TAP was involving faculty and graduate students from several colleges and was moved to the newly formed Office of Engagement in 2002. In 2005 under the leadership of a new state administration, Purdue was asked to integrate Indiana's Manufacturing Extension Partnership (MEP) center (previously managed by a state agency) with the Technical Assistance Program. MEP is a federal manufacturing competitiveness initiative established in 1990 by the National Institute for Standards and Technology, and each center carries out its mission with federal, state, and fee-based funding. The integration of Indiana's center with TAP has enabled the manufacturing sector to engage a broad range of Purdue expertise. Also in 2005 the Indiana Hospital Association requested access to teams of engineering and clinical faculty that could address performance

with the National Institute of Standards and Technology's Manufacturing Extension Partnership (MEP). The agreement is contracted to Purdue through the Indiana Economic Development Corporation. MEP provides comprehensive services to over 400 manufacturers per year to advance innovation and global competitiveness. MEP also facilitates connections with Purdue for many companies to assist in recruitment of students for internships and full-time positions, research, and degree and certificate programs. Although the primary focus of MEP is manufacturing, other sectors that take advantage of its performance improvement services include banking, government, workforce development organizations, and Purdue University.

- Energy Efficiency & Sustainability unit (2006): Helps companies and other organizations improve processes and develop energy management practices through workshops, on-site training, awareness events, implementation, and consulting services.
- Green Enterprise Development unit (2008): Helps companies optimize material and energy resources during the design, manufacture, and end use of products in order to reduce production costs, eliminate negative environmental impacts, and increase business opportunities.
- Advanced Modeling and Simulation group (2011): A team of selected engineering faculty and graduate students who are assisting manufacturers with the adoption of advanced product and process modeling technologies. This work is performed through membership in the National Digital Engineering and Manufacturing Consortium.

Purdue Healthcare Advisors (formerly the TAP health care group) provides a number of services for the health care sector:

- Lean Healthcare unit (2005): Applies lean methodology, six sigma tools, consulting projects, simulation and modeling, and many other performance improvement practices to hospitals and other health care providers to improve patient care, quality, safety, and productivity.
- Community Health unit (2006): Addresses critical issues facing public and population health through performance and quality improvement methodologies for workforce training and resource management.
- Purdue Regional Extension Center (2010): This cooperative agreement with the Department of Health and Human Services assists providers with the adoption and meaningful use of electronic health records to improve patient care.

Key Factors Supporting TAP's Engagement Model

The success of TAP engagement derives from many factors. In some cases only a few of these factors are relevant to a partnership; in other cases several factors must align to develop an engagement. We describe here a number of elements that are critical to TAP's success.

1. Partnership with a major land-grant research institution. A broad range of health care, manufacturing, and governmental clients cite several factors that position Purdue as a preferred partner. First, the service mission of TAP directly supports the innovation, performance improvement, and competitiveness needs of the business sector. In addition, TAP's service mission for health care is closely aligned with the patient care, quality, safety, and productivity missions of this largely not-for-profit sector. Second, several partnerships, such as cooperative agreements and other federal and

state initiatives, require broad expertise and substantial capacity to manage large, multiyear engagements and serve large regions, often encompassing the entire state. Third, many constituencies repeatedly engage TAP based on a strong history of responsiveness and commitment to quality. Finally, several clients are attracted to the value of TAP engagements that are characterized by low costs and yet provide a broad range of capabilities and subject matter expertise through the university's faculty.

2. Needs and opportunities identification. TAP employs many mechanisms to keep abreast of evolving societal needs and opportunities for service. For example, the TAP leadership staff is well connected with senior Purdue faculty, staff, and administrators who are active participants in economic development organizations, professional societies, and business and health care associations. TAP personnel participate in community planning events, trade shows, conferences, planning groups, and economic strategic planning; they are members of boards and councils of several economic development and health care organizations. TAP receives valuable input from an active 20-member advisory council that meets twice annually for a full day; TAP similarly receives input from partnerships with several health care organizations. In many cases the health care, manufacturing, and government sectors take the initiative to approach TAP with specific needs and opportunities to partner. This broad-based input, combined with careful monitoring of grant opportunities and various studies and reports, as well as initiatives of federal, state, and local organizations, has supported TAP's development of effective partnerships that address societal needs.

3. Service-oriented focus. TAP carefully works not only to gain a thorough understanding of the expressed needs of its clients, but also to discern the unexpressed opportunities to engage with those served. Once expressed needs are fully understood, TAP initiatives are designed and managed to engage the most effective mix of faculty, students, staff, and others that will meet the objectives. Senior capstone projects, experiential learning, and other important faculty and student experiences in support of the education mission of the university are often leveraged, but the TAP-managed initiatives are solely client-focused and are not constrained by academic objectives. Even so, the approximately 90 participating faculty and students consistently report positive impacts on their teaching and research from their experience with businesses and health care providers, and the graduating students report positive impacts in terms of job offers. These results are consistent with studies of the impact of engagement on faculty and students (Beckman et al., 2011; McKinnis, McNamara, Kuczek, & Salvendy, 2001; Nicotera, Cutforth, Fretz, & Thompson, 2011).

TAP also draws on its knowledge of the latest research and best practice technologies and methodologies and offers potential partners many levels of engagement, from incremental improvements to transformational change and technology adoption. This knowledge of "what can be" is derived from the research developments of the faculty at Purdue and elsewhere, the literature, conferences, and other sources. For example, faculty research at Purdue on developing advanced computational fluid dynamics modeling capability is being applied to the design of more efficient vacuum pumps and enhanced vascular medical devices through TAP's participation in the National Digital Engineering and Manufacturing Consortium. In another example, simulation modeling and prediction capabilities developed by a Purdue research group based on complex inputs are being applied to the prediction of early readmissions and the development of intervention strategies in a major initiative involving 120 hospitals. Research papers providing a basis for these two adoptions of technology include Delorme et al. (2012) and Konrad et al. (2007).

4. Development of client-focused partnership agreements. Purdue has a broad vision for engagement: to serve society with "profound scientific, technological, social, and humanitarian impact that advances societal prosperity and quality of life"

(Purdue University, 2008, p. 7). Many creative partnerships have been developed in light of this vision. Partners frequently present TAP with agreement conditions and components that are not typical of federal and private-sector agreements commonly used at universities. In keeping with Purdue's engagement vision, creative new mechanisms have been developed by Purdue's contracting and business personnel to accommodate these unconventional terms. Examples of TAP's many forms of partnership are listed below.

- Large federal cooperative agreements: Examples of such agreements include those with the Workforce Innovation in Regional Economic Development (WIRED) initiative of the Department of Labor, the Manufacturing Extension Partnership (MEP) of the National Institute of Standards and Technology, and the Healthcare Information Technology Regional Extension Center (HITEC REC) initiative of the Department of Health and Human Services. These agreements have greatly expanded the scope of TAP's operations by leveraging large federal investments; they have also helped grow its capacity and expertise. Purdue's accommodations for these agreements have included authorizations to supply a required endorsement of carefully selected software providers, to meet a requirement to identify and name start-up staff, and to invoice for payment based on meeting specified milestones.
- Fees for service: These partnerships are initiated by both TAP and its clients. The work performed includes training, performance improvement, technology adoption, consulting, problem solving, and several other tasks. TAP has a strong reputation for quality and value, and many of these engagements are executed without competitive bidding. In these partnerships, Purdue has permitted TAP to invoice upon completion of service, as is done in the private sector and as is expected and requested by those served.
- State agency partnerships: TAP has supported the initiatives of several state agencies, including the Indiana State Department of Health, the Department of Workforce Development, the Office of Energy Development, the Indiana Department of Environmental Management, the Indiana Department of Transportation, and the Indiana Economic Development Corporation. These partnerships have been initiated by both the agencies and TAP, and in some cases have become long-term relationships. For most of these partnerships, Purdue enables TAP to provide services on a fixed-price basis (payment for deliverables) instead of a cost-recovery basis. This arrangement is well received by the state agencies that seek simplified invoicing and a focus on deliverables.
- Health care association partnerships: TAP has ongoing partnerships with the Indiana Hospital Association and the Indiana Rural Health Association, and has smaller partnerships with several other associations. Funding sources include hospitals, federal grants, and community and foundation grants.
- State funding for business assistance: Since 1986 the State of Indiana has funded business assistance through TAP. Most of this assistance is provided at no cost through carefully managed, faculty-based consulting projects on a broad range of technology, business, human resources, and performance improvement topics. Companies must meet certain qualifications to receive assistance, and in many cases these projects lead to other Purdue and TAP engagements.
- Community partnerships: TAP has partnered with community economic development organizations, community foundations, and local universities to provide service to manufacturers and hospitals. These partnerships

have been formed by mutual agreement and are funded by multiple sources.

5. Evidence-based evaluation and assessment of performance. Performance excellence is an essential feature of all TAP initiatives. Each engagement of one day or more includes a signed written statement of objectives, deliverables, and expected outcomes and impacts. TAP utilizes a quality system that includes several mechanisms to collect evaluation data on subjective and objective measures of performance. For extended engagements, subjective feedback may be obtained daily or weekly. The evaluation data serves several purposes. First, it is used by TAP project managers to ensure that the outcomes of each project, initiative, or assignment are meeting client expectations. In rare cases of performance issues, the evaluation data and subjective feedback are used to support immediate resolution. Second, the evaluation data are used by the faculty, student, and staff participants to monitor and improve their effectiveness. Third, the feedback information, outcome, and impact data are included (with appropriate permissions) in reports required by certain sponsors (for example, large cooperative agreements) and are used in summary reports and annual reports that support ongoing and new partnership initiatives.

6. University support. TAP receives broad-based acceptance and support from the university. Purdue's commitment to service and engagement is outcomes- and impact-based. TAP's initiatives yield many economic impacts, measures of success, and anecdotal examples that are well received by senior administrators, deans, and heads who seek faculty participation in such initiatives. The university strongly endorses TAP's funding model, which includes over 200 sponsors from a broad range of sectors. No general funds are provided; instead, TAP returns significant facilities and administration (overhead) funds to the university. Thus in a budgetary sense, TAP is revenue-neutral to the university, as well as defraying the costs for human resources, contracts, business office, and other services provided to TAP. Finally, TAP is housed within the Office of Engagement under the leadership of a senior faculty member with a full understanding of the value and importance of Purdue's engagement mission.

Operationally, Purdue supports and enables TAP in many ways, a few of which are listed here:

- Broad endorsement by the university: The president provides a letter of endorsement in TAP annual reports; the Purdue Alumni Association features TAP achievements in its *Alumnus Magazine*; Purdue Marketing and Media develops TAP publications and issues numerous media releases; Purdue governmental relations strongly promotes new state and federal partnerships; and TAP initiative and success stories are included in many Purdue speeches, reports, and websites.
- Facilitation of faculty participation: TAP is authorized to compensate faculty through overload payments, partial appointments, and support of graduate students. In some cases faculty are engaged for work requiring responses in a day or two. Faculty members with significant participation have included the impact of their work in promotion and tenure documents; faculty members have also used their engagements with TAP to inform teaching, research, conference presentations, and publications. Purdue's culture of engagement is strong. Nearly all faculty approached by TAP consent to participate in its initiatives. Each year TAP involves 50 to 60 faculty participants in efforts ranging from a few days to several months.
- Accommodation of unique personnel and contractual needs: For example, in one partnership TAP funds a health care association to promote the use of

TAP's performance improvement services to its members. Some partnerships require TAP to utilize nonuniversity personnel, limited-term employees, subcontractors, and other forms of human resources to support very quick responses. In some cases, the university has permitted TAP to employ professional staff on "soft" funding with the objective of developing long-term funding streams. TAP has also participated in many large partnerships that have presented contractual and other requirements that conflict with Purdue policies and practices. In nearly all cases, Purdue leadership has developed solutions to these issues through good-faith negotiations with TAP and its partners.

TAP's Operational Model

Six key characteristics of the operational model for TAP focus on achieving operational excellence in all its partnerships.

1. A consulting services business model. TAP's business model is designed with the flexibility to undertake a range of engagements requiring from a few hours to a few years, with funding of a few hundred to a few million dollars, and with the number of Purdue participants ranging from one to 100. Each group and unit has a designated manager, and each project and initiative has a defined work statement, project manager, and project team. Fluctuations in personnel needs are accommodated by distributing assignments across a large number of projects and employing a combination of full-time staff, faculty, graduate students, subcontractors, and limited-duration and temporary staff. Fiscal management is complicated due to the large number of funding sources (over 200) that present a broad range of compliance, invoicing, confidentiality, liability, and other stipulations. Several mechanisms are employed to plan and control budgets and expenditures in this complex environment.

2. Quality system. The TAP quality policy is clearly stated: "Projects are carried out in a professional and confidential manner; we strive for accuracy and quality in all we do." TAP's quality system is ISO 9000 compliant and contains 85 documents specifying procedures, forms, and checklists for numerous operational functions. One simple example is illustrated in Figure 2. The quality system supports performance excellence through standardized procedures, quality checklists, designated responsibility for corrective actions, and prevention of errors and omissions in project work. Overall quality measures from those served are consistently positive.

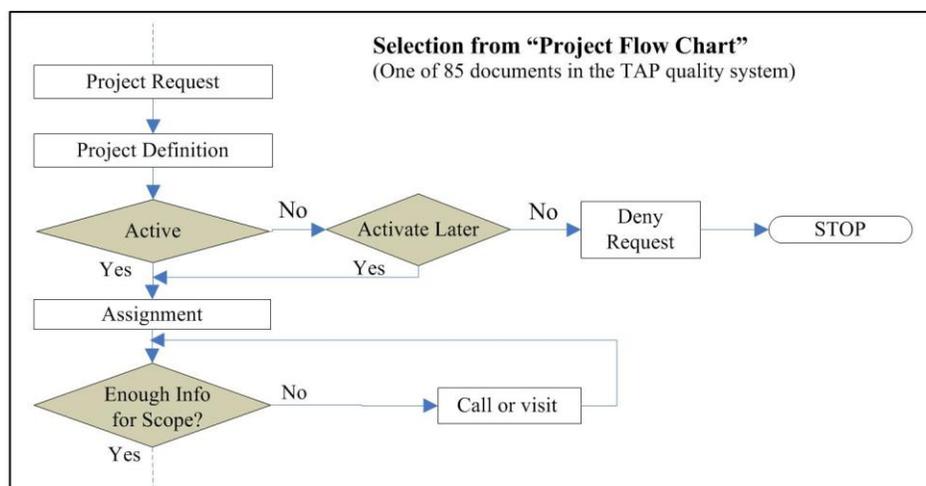


Figure 2. A representative TAP project flow chart.

3. Clearly stated engagement agreements. All TAP engagements of more than one day of effort contain a scope of work statement specifying the expected deliverables and outcomes, costs, timing, the designated TAP project manager, the client contact, the client evaluation requirements, and other components.

4. Selection and training of Purdue participants. TAP's quality system includes procedures for the selection and training of faculty, graduate students, staff, and other participants. All new participants sign confidentiality agreements and are informed of basic procedures, TAP's mission and objectives, and the evaluation and feedback mechanisms. New graduate students and full-time staff receive basic orientation and appropriate training for their specific assignments.

5. Responsiveness. Purdue supports rapid responsiveness to client needs. TAP is enabled to provide fee-for-service proposals in one day and has options to engage faculty, graduate students, staff, and subcontractors with a few days' notice. Responsiveness is a key to many of TAP's small and medium-sized engagements.

6. Administrative support. TAP provides administrative support for participating faculty, graduate students, and staff. Support includes report-writing assistance, meeting logistics, travel arrangements, and many other tasks that allow participants to focus on technical contributions.

Evolving Growth in Scope, Partnerships, and Impact of TAP's programs

The Technical Assistance Program has its roots in the State of Indiana's response to the recession of the 1980s, when significant economic and global competitiveness challenges emerged, creating structural changes in the manufacturing and business sectors with effects lasting to this day. TAP closely monitors these structural changes in its ongoing development of new initiatives and services.

For example, in the manufacturing sector several trade and policy associations, advocacy groups, and consulting firms are advocating innovation and transformation. A recent Council on Competitiveness (2011) report stated, "American Manufacturing is either in steep decline, doing reasonably well or poised to grow. Widely available reports and analyses support each of these conflicting views" (p. 8). This report asserted that manufacturing is a key element of economic growth, and presented strategies for transformation. The Manufacturing Performance Institute and the American Small Manufacturers Coalition have also presented strategies for manufacturing growth, based on the premise of the importance of manufacturing (Manufacturing Performance Institute, 2011). The National Association of Manufacturers (2012) is actively promoting a renaissance in this sector, the Boston Consulting Group (2011) is reporting a resurgence of U.S. manufacturing, and there are anecdotal descriptions of just such a resurgence (Fishman, 2012). The federal government is funding substantial initiatives in manufacturing. A recent example is the National Additive Manufacturing Innovation Institute, a public-private partnership (U.S. Department of Commerce, 2012).

In its first 18 years, TAP services to business, industry, and government consisted of short-term faculty assistance supported by state funding, and most work was performed in the manufacturing sector. At the request of the state government in 2005, Indiana's Manufacturing Extension Center (MEP) was moved to TAP with the objective of increasing the effectiveness of state and federally funded programs. As a result, TAP added many services designed to make performance improvement impacts. For example, in 2008, TAP conceived and produced a Green Enterprise Development program with U.S. Department of Labor funding. Faculty in the College of Technology created the basis for the curriculum, and the MEP staff pilot-tested, modified, and refined the content into a 56-hour training program linked to a Society of Manufacturing

Engineers' certification. This program has been adopted by community colleges and MEP centers in 15 states. This initiative was supported with total funding to TAP exceeding \$1.7 million from multiple private and public sources, including the state's adoption of this initiative for displaced worker training. TAP program services for business, industry, and government have evolved as shown in Figure 3 to over 100 programs.

Services & Funding Sources Added by Time Period				
Services Added				
<ul style="list-style-type: none"> • Faculty Assistance Projects 	<ul style="list-style-type: none"> • Lean & Six Sigma • Quality Systems • Energy Efficiency 	<ul style="list-style-type: none"> • Sustainability • Business growth 	<ul style="list-style-type: none"> • Save Energy Now • ISO 50001 	<ul style="list-style-type: none"> • Innovation Engineering • Frontline Green Worker • Market diversification
Funding Sources Added				
<ul style="list-style-type: none"> • State of Indiana 	<ul style="list-style-type: none"> • Manufacturers • NIST Manufacturing Extension Partnership 	<ul style="list-style-type: none"> • IN Economic Development Corp. • Local Economic Dev. Organizations • U.S. Dept. of Labor & Economic Dev. Association • IN Office of Energy Dev. 	<ul style="list-style-type: none"> • U.S. Dept. of Energy • Companies • MEP centers & community colleges in 15 states 	<ul style="list-style-type: none"> • IN Dept. of Workforce Development • State grants
1986-2004	2005-2006	2007-2008	2009-2010	2011-2012

Figure 3. The evolution of TAP services and funding sources since its inception in 1986.

One example of TAP's impact is reflected in the operations of Red Gold of Orestes, Indiana, a company that has been producing premium-quality tomato products since 1942. The company has multiple long-term partnerships with Purdue through the College of Agriculture, the College of Technology, and TAP. In 2006, Red Gold partnered with TAP to undertake a multiyear workforce transformation project that has involved and trained hundreds of their employees and resulted in millions of dollars in improvement to their business in costs avoided, new investment, and capacity development.

The majority of organizations currently served by TAP are utilizing productivity and performance improvement training, consulting, and implementation. However, TAP services for other important needs are growing. These include innovation in product and process development, sustainability initiatives and "green" business practices, and workshops and training on a broad range of technical and operational topics. TAP is continually adding capability to meet these needs. The scope of sectors served by TAP continues to expand. In the past 2 years, TAP has undertaken performance improvement initiatives for Purdue University, the Indiana Department of Environmental Management, the Indiana Department of Workforce Development, and the Indiana Department of Transportation. Many additional governmental sector initiatives are currently under discussion.

In order to fully serve its diverse clients, TAP partners with many internal and external groups. The Purdue Center for Regional Development manages the U.S. Economic Development Administration university center grant and partners with TAP to conduct regional workshops on a range of economic development topics. Purdue faculty members are a critical component of TAP's offerings. The faculty bring capabilities that are in demand, relatively affordable, and often not readily available outside Purdue. In addition to undertaking projects utilizing their core analytical and technical problem-

solving skills, faculty develop training and provide public seminars on selected topics. The most utilized faculty disciplines to date have included leadership development, business management and strategy, product development, and industrial engineering tools and analysis. External partners include Ivy Tech Community College, Vincennes University, local economic development groups, and other community and economic development entities.

TAP's work in the business, industry, and government sectors is strongly focused on developing measurable impacts. Most of TAP's reported impact to date derives from the MEP center's work in Indiana's large manufacturing sector. The center's cooperative agreement with the National Institute of Standards and Technology (NIST) prescribes the collection of economic impact data through a well-defined protocol utilized by all MEP centers. Impact for the Purdue MEP center from July 2005 through June 2012 includes 8,994 jobs created and retained; \$644,707,000 in sales created and retained; cost savings of \$85,647,000; and \$171,529,000 in investments.

Operationally, the TAP services group is centrally located in the state capital of Indianapolis, with additional staff strategically placed throughout the state, usually at a Purdue facility. Contributing faculty are drawn from Purdue's main campus in West Lafayette as well as from its regional campuses and College of Technology statewide campuses in several additional locations. The group embraces the TAP quality system and receives consistently high satisfaction scores. The group served 507 business, industry, and government employers in the past fiscal year, received \$4,954,000 of funding from 121 sources, and engaged 146 faculty, students, and staff in programs, services, and initiatives.

Meeting the Pressing Need for the Adoption and Meaningful Use of Electronic Health Records

The Institute of Medicine (IOM) report *To Err is Human* (Institute of Medicine, 1999) provided the general public a first comprehensive insight into the substantial safety issues within the United States health care system. Reporting that between 44,000 and 98,000 people died each year in U.S. hospitals as a result of medical errors, the report further described the overall cost burden of these incidents to be between \$17 and \$29 billion. This report was followed a year later by the IOM report *Crossing the Quality Chasm* (Institute of Medicine, 2001). This report became a rallying cry for health care providers to improve the quality of care they delivered. The report skillfully highlighted that "the healthcare system as currently structured does not, as a whole, make the best use of its resources" and further reflected that the health care system had made very little progress in improving quality and controlling costs. These two significant reports caused hospitals to seriously examine quality within their organizations. Although most health care organizations had some form of quality program in place, most began to realize that they did not possess the knowledge base or infrastructure required to make fundamental, systemwide changes that would truly improve the quality of care delivered to patients.

Based on the identified need for improvement in hospitals and health care organizations, initiatives were undertaken to implement systems engineering principles in the health care system. The report *Building a Better Delivery System: A New Engineering/Health Care Partnership* (Institute of Medicine and National Academy of Engineering, 2005) specifically discussed applying a "systems approach" to health care delivery and utilizing the tools of systems engineering.

The Indiana Hospital Association (IHA), which represents 133 acute care hospitals in Indiana and is the home of the Indiana Patient Safety Center, provides its constituents with relevant information, tools, and resources to assist them in meeting the

challenges of achieving quality patient care while maintaining cost efficiency. Based on the aforementioned reports, the IHA identified a genuine need for a resource to assist hospitals in applying systems engineering principles to their respective organizations to improve the quality of care. The IHA provided a \$50,000 seed grant to TAP to develop this resource and launch a program dedicated to improving quality of care in Indiana hospitals.

The project started with two faculty members and three graduate students providing consulting services in patient flow and layout analyses. By 2006 the demands for this service grew to such a degree that the faculty alone could not balance teaching and research obligations while consulting and managing projects. Individuals with clinical and quality expertise were employed by TAP as full-time dedicated staff in 2007. This enabled faculty to serve as subject matter experts with the support of dedicated project managers to handle project logistics.

In late 2006 the Indiana State Department of Health also approached the TAP health care group to develop a quality improvement training program for public health workers throughout the state. It was becoming clear at the time that hospital systems, in order to make transformational changes within their organizations, would need more than layout redesign and patient flow assistance from Purdue. In response, the TAP health care group created lean health care and lean six sigma curricula specifically tailored for the health care sector, including hospitals, clinics, and public health organizations. The intent of these curricula was to build on successful, evidence-based performance improvement and technology adoption practices from industry, fully adapt these principles to health care settings, and deliver highly effective offerings to targeted health care audiences. These curricula were well received among health care workers and enabled broad access to Indiana hospitals and public health departments. A key to the successful implementation of the curricula was Purdue's success in employing clinical subject matter experts and systems engineering, as well as quality experts to deliver the training, certification, and implementation programs.

In recent years the federal government has increasingly spurred hospitals and health care providers to improve care and control costs. However, little funding was provided to assist the organizations in their efforts. With the passage of the American Recovery and Reinvestment Act of 2009, a heightened focus on health information technology permitted an unprecedented flow of funds to hospitals and health care providers to make fundamental changes to their organizations through adoption of electronic health records intended to improve patient care. A key component of this legislation was the formation of Regional Extension Centers throughout the United States that would assist primary care providers, community health centers, and critical access hospitals in the selection, implementation, and attainment of "Meaningful Use," a set of federal standards defined by the Centers for Medicare & Medicaid Services that govern the use of electronic health records (Medicare and Medicaid Programs, 2010).

In 2009, Indiana had over 8,000 primary care providers, 33 critical access hospitals, and over 100 community health centers. Less than 20% practiced active use of electronic health records. The TAP health care group's significant work in process improvement, its ability to rapidly mobilize Purdue resources, and its existing relationships with hospitals and health care providers across the state positioned Purdue to submit a successful proposal for a Regional Extension Center.

In February 2010 Purdue received a \$12 million award for the TAP health care group to establish the Indiana Regional Extension Center (REC). This project immediately employed 20 staff to start the process of assisting providers. Crucial to prompt and successful implementation of the grant award was the engagement and service infrastructure that the university already had in place through the TAP health care group. The REC staff was able to "hit the ground running" in its challenging work of technology

adoption of electronic health records.

To date the REC has worked with approximately 2,300 providers, 27 critical access hospitals, 19 hospitals, and 81 federally qualified health center sites to adopt electronic health records (EHR) technology. Through the REC's assistance these providers have realized over \$94 million in earned incentives. These incentives are based on achieving full implementation of electronic health records and utilizing the system to improve patient outcomes. A key element of the Purdue proposal was demonstrating the capacity to develop sustainability of the center before the project period end date of early 2014. The sustainability plan has progressed well, with the REC having signed over \$570,000 in fee-for-service contracts through late 2012.

The TAP health care group enjoyed considerable additional growth in the past year, and it adopted the name Purdue Healthcare Advisors (PHA) to communicate the full scope of its health care performance improvement and technology adoption capabilities. The tag line "Transforming healthcare through innovation solutions" reflects the PHA mission. In the words of Michelle Haendiges, of Haendiges & Associates, PC (quoted in Purdue Technical Assistance Program, 2012):

I advise other physicians to grab someone's hand—like Purdue—and let them guide you through the EHR [electronic health records] Meaningful Use process. Now my patients don't have to call into the doctor's office for lab results, because we have a secure, web-based portal that gives patients access to their own clinical information—in detail and without unnecessary delays. (p. 5)

Hospitals, health systems, and providers increasingly recognize that solving complex health care system problems requires high-level external expertise such as that available through PHA. Funding levels from hospitals, the federal government, and other sources for these initiatives is unparalleled, and PHA is receiving record numbers of requests for assistance. PHA currently employs over 50 staff, faculty, and graduate students, works with over 100 hospitals and health care providers a year, and is funded by over 100 sources. This is but one recent example of the scope and impact of the university engagement model offered in this essay.

Future Challenges and Opportunities

The evolving needs of society and the changing nature of universities present several challenges and opportunities for the TAP engagement model discussed here. We present a few representative possibilities for increasing and measuring impacts, as well as for broadening the scope of the model.

Achieving shorter-term solutions and impacts. For example, the TAP cooperative agreement with the Department of Health & Human Services is driving the adoption of electronic health records in a fraction of the time required just a few years ago. Shorter term responses require updated university procedures for proposal development, contract issue resolution, and staffing, and require TAP's support systems and culture to be even more time-sensitive. The time challenges are especially difficult for faculty, who are typically fully committed a semester or more in advance, and cannot easily adjust commitments in a few days or weeks to accommodate urgent new opportunities.

Measuring and documenting impact on faculty and graduate students. TAP's faculty participants consistently report satisfaction with their work and provide anecdotes of impacts on their teaching, research, and, in a few cases, promotion and tenure. TAP's graduate students consistently report a positive impact in job searches, often receiving more offers than other students. Measuring and increasing these impacts remains an

unfulfilled opportunity.

Thinking strategically regarding new opportunities, partners, and models for service. Purdue and TAP are presented with an ever-increasing range of new engagement opportunities. Some are not a good fit with current Purdue capabilities but represent an important societal need. Others are a strong fit with Purdue but have available alternate solution providers. Several opportunities involve a compelling need but have no readily apparent source of funding. Most recently, the private sector has approached TAP with several requests to partner where the university and private sector missions are aligned. These situations present opportunities that require careful strategic review.

Reflections on the TAP Engagement Model

The engagement model described in this essay has been developed over the past 27 years with consideration of efforts at other universities, networking with practitioners and scholars, participation in scholarship of engagement conferences and events, discussions with external partners and those served, and risk-taking. In recent years several universities have inquired about TAP's experience, seeking to develop or increase initiatives that achieve societal impacts. The Technical Assistance Program demonstrates a business model appropriate for a large-scale systems impact effort that offers sustainable financial resources for program support as well as significant impacts on economic development and societal advancement.

Although the development of an engagement model is always a work in progress, we consider certain attributes of the TAP model fundamental to achieving performance improvement and technology adoption in health care, manufacturing, and government. This essay is intended to provide a detailed discussion of Purdue's model. Certain fundamental characteristics, however, especially those having to do with leadership and culture, would likely be approached differently by other institutions, depending on their unique culture and leadership environments:

- *A culture of faculty participation in engagement:* Purdue faculty consistently accept opportunities to participate in TAP, even though in most cases such participation does not directly affect promotion and tenure. Those served seek faculty involvement and report high regard for faculty contributions. Using examples presented in this essay, other universities seeking to replicate the TAP model should seek to achieve a culture of faculty participation in ways that fit their institutional policies and practices.
- *A culture of university leadership and support for engagement:* Purdue's presidents and senior leadership consistently embraced a vision for achieving societal impacts through engagement. Engagement leaders visiting Purdue have disclosed limitations in achieving such a culture among their senior leadership. These institutions may find that alternate approaches—consistent with their leadership environment—will result in strong university support of engagement.
- *State leadership in engaging Purdue (and other institutions of higher education) to meet societal challenges:* The State of Indiana has requested Purdue leadership for state and federal initiatives and has asked TAP to provide business assistance, performance improvement training, and consulting in its agencies. Several universities in discussion with Purdue have reported difficulty in achieving such a culture in their states, yet in keeping with Purdue's model, these institutions should find ways to convey the value of engagement to their legislatures.

Some fundamental characteristics of the TAP model, however, are more easily replicated:

- A consulting business model: The TAP business model has been developed over several years. Most of TAP's leadership is drawn from the private sector, bringing an important user perspective to the university. Those served appreciate the options to engage faculty, students, and staff through responsive, flexible, and well-managed mechanisms. The university supports a model that relies solely on external funding and is integrated with the colleges. In addition, the faculty embraces a model that engages them with projects of interest in a productive and well-defined manner.
- Core funding for leverage: In TAP's experience the availability of core funding has been essential to success. TAP's core funding comes from state funding for business assistance. This funding has enabled TAP to provide matching funding for a large federal cooperative agreement, allowed TAP to serve important needs of the day such as Clean Air Act compliance in the mid-1990s, and permitted TAP to provide limited no-cost assistance that leads to significant fee-based engagements.
- Multiple options for faculty, student, and professional staff engagement: TAP provides its services through a combination of full-time staff and faculty, students, and professional staff from other Purdue departments. The multiple options for participation from those outside TAP, especially the faculty, have been essential to meeting the needs of those served, in many cases making TAP the only service option they have considered.

Based on the TAP experience, we conclude that universities can develop successful engagement models to address challenging societal issues in health care, manufacturing, government, and other sectors. The university's role in this evolving domain is challenging, and requires creative and innovative thinking, commitments to enable faculty and staff to serve in a flexible and highly responsive consulting model, and commitments to develop client-focused partnerships. Those served are attracted to the subject matter expertise of the faculty and seek practical and effective methodologies to apply this expertise to a long list of tough issues. Although developing effective models of technology adoption and performance improvement is difficult, the needs of society present a compelling case for universities' making strong commitments to meeting these pressing challenges.

[[Footnote]]

¹ Most of these data were obtained by a third-party survey firm under contract with the National Institute for Standards and Technology.

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